

Application Note

How to use phyCAM camera modules with the phyBOARD-MIRA-i.MX6 SBC

Revision History

Version	Changes	Author	Date
A0	Initial Release	H. Fendrich	21.08.2015
A1	Describe the settings for camera (in YOCTO PD15.3.0)	H. Fendrich	29.03.2016

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1 Overview

The i.MX6 Microcontroller supported more than 1 camera interface (see Fehler! Verweisquelle konnte nicht gefunden werden.).

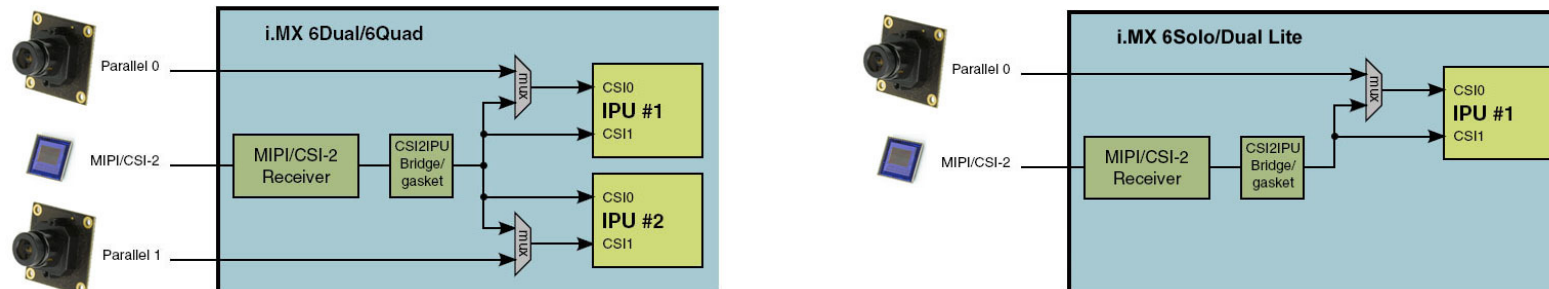


figure 1: Block Diagram Camera Interfaces of i.MX6 Controller (Quad / Dual) and i.MX6 Controller (Solo / Dual Lite)

On the phyCORE-i.MX6 the CSI0/IPU#1 camera path go out as parallel signal.

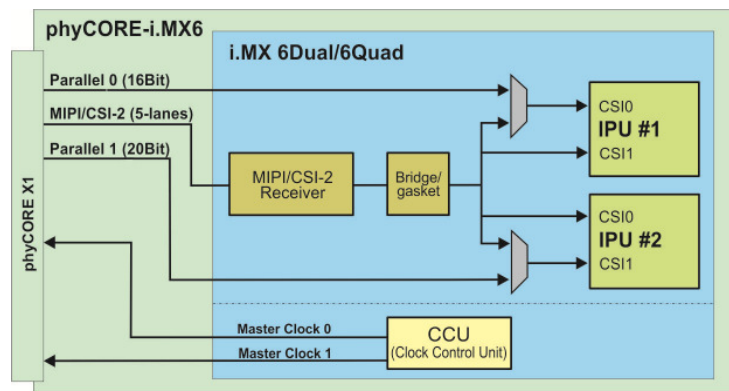


figure 2: Use of Camera_0 (CSI0 of IPU#1) and Camera_1 (CSI1 of IPU#2)

On the PHYTEC or customer carrier boards can the interfaces are led out as phyCAM-P (or raw-parallel) see

figure 3 and/or phyCAM-S+ see figure 3, or MIPI/CSI 2 interface. For more information to phyCAM-P/S+ see manual L-748.

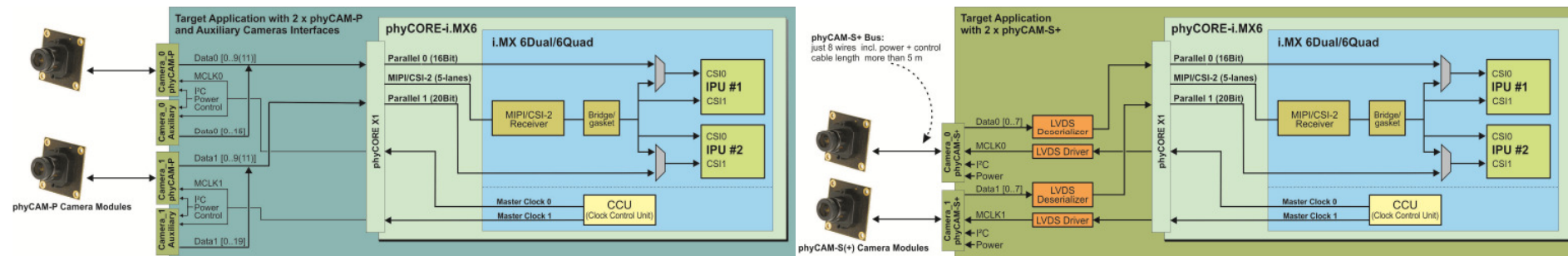


figure 3: Block Diagram of an phyCAM-P solution and an phyCAM-S (+) solution with phyCORE-i.MX6 (Quad / Dual) SBC

On the phyBOARD-Mira baseboard is only the CSIO/IPU#1 camera path (thru a serializer) go out as LVDS signal (see figure 4). Here you can connect one of the different phyCAM-S(+) camera modules. See the phyCAM-P-/S manual L-748 for more information.

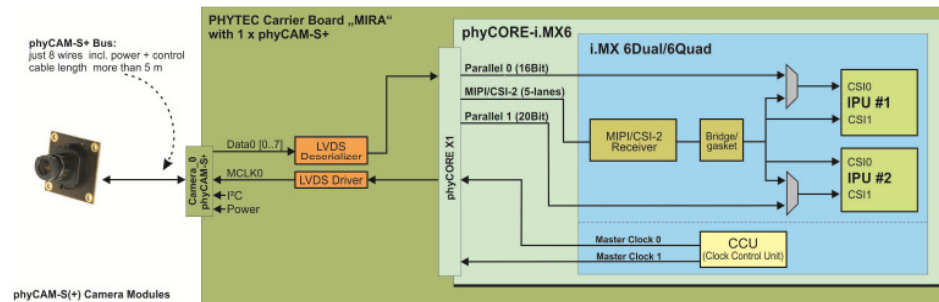


figure 4: Block Diagram of phyCAM-S(+) Camera Interfaces of phyCORE-i.MX6 (Quad / Dual) and the go out on the phyBOARD-MIRA-i.MX6 - SBC

The BSP shipped with the Kit includes already the software drivers for the supported phyCAM camera modules. The drivers are compatible with v4l2. Also GStreamer scripts are included for the evaluation of the camera modules. If you need more then one camera interface or/and phyCAM-P support, please use the phyFLEX-i.MX6 Modul.

Note:

The phyBOARD-MIRA features one CSI interface for phyCAM-S(+) camera modules.
Please find more information about the camera support in the path: ...\\Documentation\\...

The kit version KPB-01501-001 is shipped with an i.MX6 controller board which has no camera support installed.
The kit version KPB-01501-002 is shipped with an i.MX6 controller board which has camera support installed.

The Linux BSP PD15.3.0 for these kits does support the phyCAM-S+ camera series from PHYTEC.
ftp://ftp.phytec.de/pub/ImageProcessing/phyBOARD-Mira-i.MX6_linux_PD15.3.0/

The table below lists the options:

Hardware Configuration		Software Support
phyBOARD Kit	phyCAM-S+ at CSI_0	phyCAM-S+ at CSI_0
KPB-01501-Video-L01	yes (VM-010-BW-LVDS-M12 is included)	yes
KPB-01501-Video-L02	Yes (phyCAM-S+ camera is selectable)	yes
KPB-01501-001	NM (at base board)	no
KPB-01501-002	yes	yes

NM = no mount

2 Camera Connectors on the MIRA - Carrier Boards

The development kits for the phyBOARD-MIRA-i.MX6 contain:

- one carrier board (MIRA)
- one phyCORE-i.MX6 modul SOM

The carrier board connects to the phyCORE-connector, with the phyCORE-i.MX6 modul.

On the base board MIRA (PBA-C-06-002) we convert the parallel Camera_0 interface in the phyCAM-S+ camera interface standard (see figure 4). The phyCAM-S+ interface is support on connector X10 (Hirose CAM). Information's to phyCAM-S+ are in the phyCAM-manual (L-748).

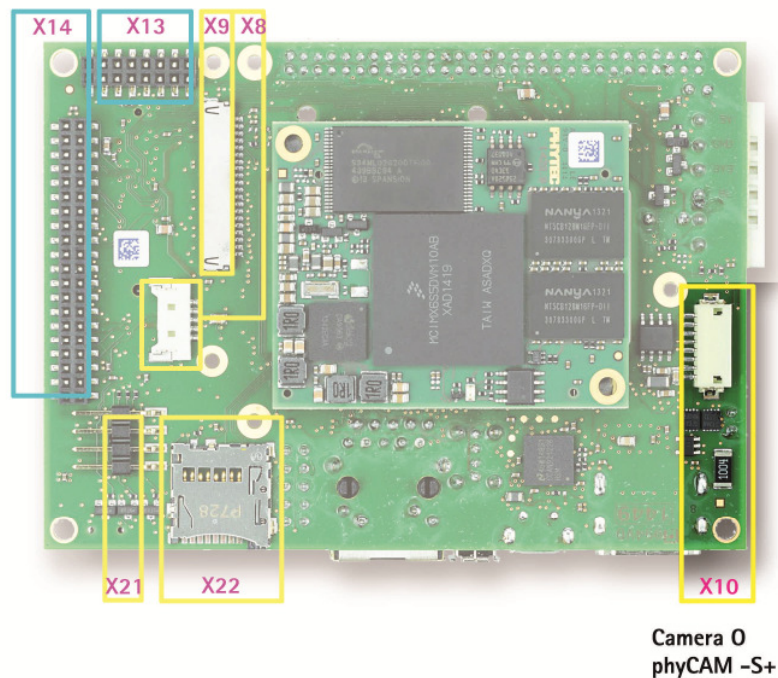


figure 5: Camera Interfaces on phyBOARD-MIRA for the phyCORE-i.MX6 SOM

3 Change the cameras or camera parameters (YOCTO Linux PD15.2.0)

The Linux BSP PD15.2.0 for these kits does support the camera VM-010-BW-LVDS. For support the other PHYTEC phyCAM-S(+) cameras you have to compile a new device tree.

Even if you want to change the camera master clock or the I2C address of the cameras, you have to compile a new device tree.

For more information see on FTP:

ftp://ftp.phytec.de/pub/ImageProcessing/phyBOARD-Mira-i.MX6_linux_PD15.2.0/

Notes:

- I²C addresses of the camera are set by hardware configuration (jumper setting on the camera and / or on the baseboard. Please refer to the phyCAM-manual L-748 and the hardware manual of the kit.

4 Change the cameras or camera parameters (YOCTO Linux PD15.3.0)

Due to the change over to the new linux kernel version, the cameras and the camera interface are no longer supported as a SOC-device, but as sub-devices.

To configure is used the multimedia framework "media control".

The conversion of the formerly from PHYTEC supported camera driver, camera interface and the IPU and VPU support is not yet complete.

For more information see on FTP:

ftp://ftp.phytec.de/pub/ImageProcessing/phyBOARD-Mira-i.MX6_linux_PD15.3.0/

The configuration in the config-expansions file must match with the camera models that are connected to the camera interfaces.

Note that model, interface type and I²C-addresses must be set correctly. Otherwise the camera(s) are not working.

Please check, if the correct camera model is set in the config file. If not, please follow the steps below to set the appropriate configuration.

Changing the setting of the config-expansions parameters

To change the config-file (config-expansions), use the Barebox environment:

- 'cd env' <enter>
- 'edit config-expansions' <enter>

The following settings in config-expansions - file are necessary:

of_camera_selection -p <csi_port> -b <csiX_cam_bus_type> -a <csiX_cam_i2c_address> <cam_type>

- csi_port = [0,1]
- csix_cam_bus_type = [phyCAM-P, phyCAM-S+]
- csix_cam_i2c_address = [0x41-0x5D] depend of camera typ/settings
- csix_cam_type = [VM-006, VM-008, VM-009, VM-010-BW, VM-010-COL, VM-011-BW, VM-011-COL]

Example: VM-010-BW-LVDS with i2C-address 0x48 on CSI0 (Camera_0) port
[of_camera_selection -p 0 -b phyCAM-S+ -a 0x48 VM-010-BW]

The parameters for the phyCAM – modules are shown in the table below (see next page).

After changing the settings with the editor:

- close the editor (CTRL D)
- type 'saveenv' <enter> to save
- restart PHYTEC module

After login, change into the directory: \gststreamer_examples\
cd gststreamer_examples <ENTER>.

Now you can start working with the GStreamer demo-scripts. Detailed information about the GStreamer examples can be found in the phyCAM-Manual L-748.

Hardware Configuration		Bootarg Parameters				Bootarg settings for default I ² C-address (default jumper on camera and boards)
phyCAM camera model (part number)	connected to	csi_port	csi[X]_cam_bus_type	csi[X]_cam_type	csi[X]_cam_i2c_address	
VM-006-BW (-M12 / -H)	Not on MIRA board	0	phyCAM-P	VM-006	0x5D, 0x41	of_camera_selection -p 0 -b phyCAM-P -a 0x5D VM-006
	Not on MIRA board	1	phyCAM-P	VM-006	0x5D, 0x41	of_camera_selection -p 1 -b phyCAM-P -a 0x5D VM-006
VM-006-BW-LVDS (-M12 / -H)	X10 on MIRA board	0	phyCAM-S+	VM-006	0x5D, 0x41	of_camera_selection -p 0 -b phyCAM-S+ -a 0x5D VM-006
	Not on MIRA board	1	phyCAM-S+	VM-006	0x5D, 0x41	of_camera_selection -p 1 -b phyCAM-S+ -a 0x5D VM-006
VM-008	Not on MIRA board	0	phyCAM-P	VM-008	0x44, 0x45	of_camera_selection -p 0 -b phyCAM-P -a 0x45 VM-008
	Not on MIRA board	1	phyCAM-P	VM-008	0x44, 0x45	of_camera_selection -p 1 -b phyCAM-P -a 0x45 VM-008
	X10 on MIRA board	0	phyCAM-S+	VM-008	0x44, 0x45	of_camera_selection -p 0 -b phyCAM-S+ -a 0x45 VM-008
	Not on MIRA board	1	phyCAM-S+	VM-008	0x44, 0x45	of_camera_selection -p 1 -b phyCAM-S+ -a 0x45 VM-008
VM-009 (-M12 / -H)	Not on MIRA board	0	phyCAM-P	VM-009	0x48, 0x5D	of_camera_selection -p 0 -b phyCAM-P -a 0x48 VM-009
	Not on MIRA board	1	phyCAM-P	VM-009	0x48, 0x5D	of_camera_selection -p 1 -b phyCAM-P -a 0x5D VM-009
VM-009-LVDS (-M12 / -H)	X10 on MIRA board	0	phyCAM-S+	VM-009	0x48, 0x5D	of_camera_selection -p 0 -b phyCAM-S+ -a 0x48 VM-009
	Not on MIRA board	1	phyCAM-S+	VM-009	0x48, 0x5D	of_camera_selection -p 1 -b phyCAM-S+ -a 0x48 VM-009

VM-010-BW (-M12 / -H)	Not on MIRA board	0	phyCAM-P	VM-010-BW	0x48, 0x4C, 0x58, 0x5C	of_camera_selection -p 0 -b phyCAM-P -a 0x48 VM-010-BW
	Not on MIRA board	1	phyCAM-P	VM-010-BW	0x48, 0x4C, 0x58, 0x5C	of_camera_selection -p 1 -b phyCAM-P -a 0x4C VM-010-BW
VM-010-BW-LVDS (-M12 / -H)	X10 on MIRA board	0	phyCAM-S+	VM-010-BW	0x48, 0x4C, 0x58, 0x5C	of_camera_selection -p 0 -b phyCAM-S+ -a 0x48 VM-010-BW
	Not on MIRA board	1	phyCAM-S+	VM-010-BW	0x48, 0x4C, 0x58, 0x5C	of_camera_selection -p 1 -b phyCAM-S+ -a 0x48 VM-010-BW
VM-010-COL (-M12 / -H)	Not on MIRA board	0	phyCAM-P	VM-010-COL	0x48, 0x4C, 0x58, 0x5C	of_camera_selection -p 0 -b phyCAM-P -a 0x48 VM-010-COL
	Not on MIRA board	1	phyCAM-P	VM-010-COL	0x48, 0x4C, 0x58, 0x5C	of_camera_selection -p 1 -b phyCAM-P -a 0x4C VM-010-COL
VM-010-COL-LVDS (-M12 / -H)	X10 on MIRA board	0	phyCAM-S+	VM-010-COL	0x48, 0x4C, 0x58, 0x5C	of_camera_selection -p 0 -b phyCAM-S+ -a 0x48 VM-010-COL
	Not on MIRA board	1	phyCAM-S+	VM-010-COL	0x48, 0x4C, 0x58, 0x5C	of_camera_selection -p 1 -b phyCAM-S+ -a 0x48 VM-010-COL
VM-011-BW (-M12 / -H)	Not on MIRA board	0	phyCAM-P	VM-011-BW	0x48,0x5D	of_camera_selection -p 0 -b phyCAM-P -a 0x48 VM-011-BW
	Not on MIRA board	1	phyCAM-P	VM-011-BW	0x48,0x5D	of_camera_selection -p 1 -b phyCAM-P -a 0x5D VM-011-BW
VM-011-BW-LVDS (-M12 / -H)	X10 on MIRA board	0	phyCAM-S+	VM-011-BW	0x48,0x5D	of_camera_selection -p 0 -b phyCAM-S+ -a 0x48 VM-011-BW
	Not on MIRA board	1	phyCAM-S+	VM-011-BW	0x48,0x5D	of_camera_selection -p 1 -b phyCAM-S+ -a 0x48 VM-011-BW
VM-011-COL (-M12 / -H)	Not on MIRA board	0	phyCAM-P	VM-011-COL	0x48,0x5D	of_camera_selection -p 0 -b phyCAM-P -a 0x48 VM-011-COL
	Not on MIRA board	1	phyCAM-P	VM-011-COL	0x48,0x5D	of_camera_selection -p 1 -b phyCAM-P -a 0x5D VM-011-COL
VM-011-COL-LVDS (-M12 / -H)	X10 on MIRA board	0	phyCAM-S+	VM-011-COL	0x48,0x5D	of_camera_selection -p 0 -b phyCAM-S+ -a 0x48 VM-011-COL
	Not on MIRA board	1	phyCAM-S+	VM-011-COL	0x48,0x5D	of_camera_selection -p 1 -b phyCAM-S+ -a 0x48 VM-011-COL
VM-012-BW (-M12 / -H) ¹⁾	Not on MIRA board	0	phyCAM-P	VM-012-BW	0x48, 0x4C, 0x58, 0x5C	of_camera_selection -p 0 -b phyCAM-P -a 0x48 VM-012-BW
	Not on MIRA board	1	phyCAM-P	VM-012-BW	0x48, 0x4C, 0x58, 0x5C	of_camera_selection -p 1 -b phyCAM-P -a 0x4C VM-012-BW
VM-012-BW-LVDS (-M12 / -H) ¹⁾	X10 on MIRA board	0	phyCAM-S+	VM-012-BW	0x48, 0x4C, 0x58, 0x5C	of_camera_selection -p 0 -b phyCAM-S+ -a 0x48 VM-012-BW
	Not on MIRA board	1	phyCAM-S+	VM-012-BW	0x48, 0x4C, 0x58, 0x5C	of_camera_selection -p 1 -b phyCAM-S+ -a 0x48 VM-012-BW
VM-012-COL (-M12 / -H) ¹⁾	Not on MIRA board	0	phyCAM-P	VM-012-COL	0x48, 0x4C, 0x58, 0x5C	of_camera_selection -p 0 -b phyCAM-P -a 0x48 VM-012-COL
	Not on MIRA board	1	phyCAM-P	VM-012-COL	0x48, 0x4C, 0x58, 0x5C	of_camera_selection -p 1 -b phyCAM-P -a 0x4C VM-012-COL
VM-012-COL-LVDS (-M12/-H) ¹⁾	X10 on MIRA board	0	phyCAM-S+	VM-012-COL	0x48, 0x4C, 0x58, 0x5C	of_camera_selection -p 0 -b phyCAM-S+ -a 0x48 VM-012-COL
	Not on MIRA board	1	phyCAM-S+	VM-012-COL	0x48, 0x4C, 0x58, 0x5C	of_camera_selection -p 1 -b phyCAM-S+ -a 0x48 VM-012-COL

Notes:

- csi[X]_cam address must be identical to the I²C-address of the corresponding camera. I²C addresses of the camera are set by hardware configuration (jumper setting on the camera and / or on the baseboard / mapper board. Please refer to the phyCAM-manual L-748 and the hardware manual of the kit.
- If two cameras are used at the same time, csi[X]_cam address must be different for CAM0 and CAM1.
- If the CSI1 port not is used, please select "none" or the same camera as at CSI0 (with other I²C-adress).
- ¹⁾ in progress

5 GStreamer function

After login, change into the directory: `\gstreamer_examples\.`
`cd gstreamer_examples <ENTER>`.

At the first start disable the QT-Demo. Start the script "remove_qt_demo.sh".

Now you can start working with the GStreamer demo-scripts.
Detailed information about the GStreamer examples can be found in the phyCAM-Manual L-748.

In this kernel version we use the media-device structure. So all camera/video components get an separate `"/dev/video[x]"` or `"dev/v4l-subdev[x]"` device.
Show the mapping with type: `"media-ctl -p"`. The capabilities are showed if you type: `"v4l2-ctl -d [device] --all"` e.g. `"v4l2-ctl -d /dev/v4l-subdev5 --all"`.